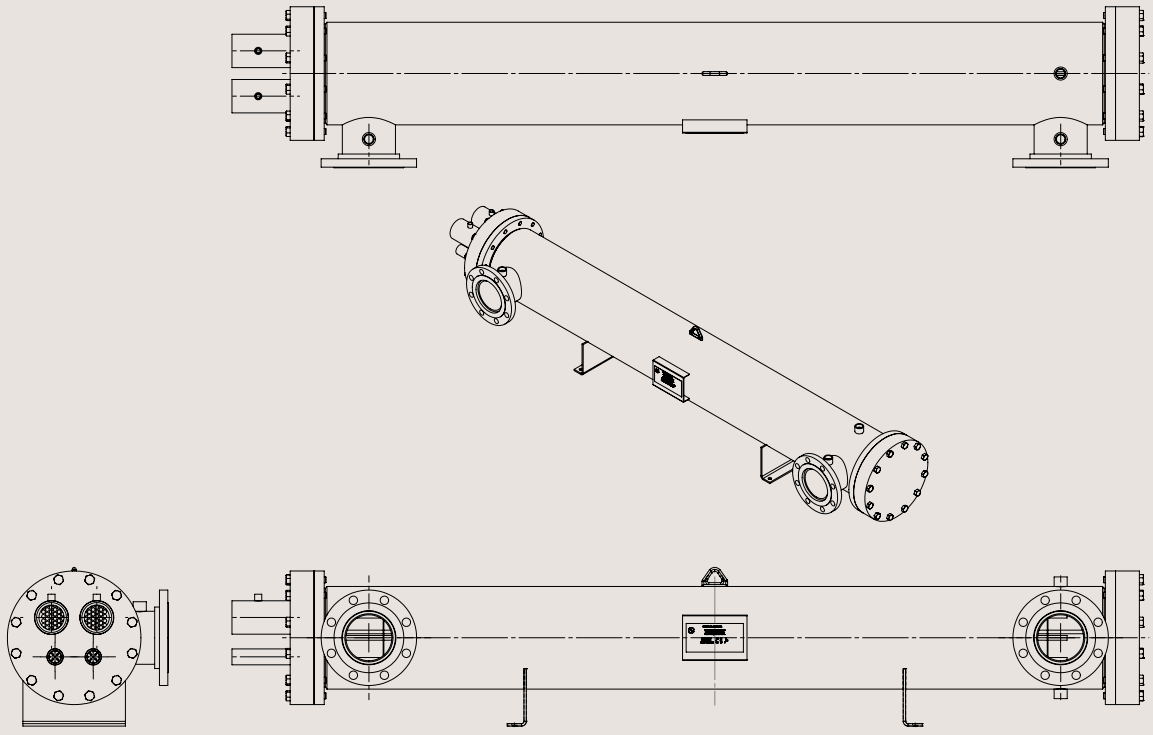
Service Manual

Commercial refrigeration solutions



Literature Code - ERC00632EN 1510

Original manual

Standard

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The information herein is correct at the time of issue but may be subject to change without prior notice.
The manual is only intended as a guide and is not intended to replace professional training or experience.

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Unsafe practices and other important information are emphasized in this manual. Warnings are emphasized by means of special signs.

Important Information

Always read the manual before using!

WARNING
Indicates that special procedures must be followed to avoid serious personal injury.

CAUTION
Indicates that special procedures must be followed to avoid damage to the pressure vessel.

NOTE
Indicates important information to simplify or clarify procedures.

Warning signs

General warning:

Pay special attention to the instructions below so that severe personal injury and/or damange to the valve are avoided.

Safety Precautions

Installation

- **Always** read the technical data thoroughly.
- **Never** touch the the pipeline when processing hot liquids.
- **Never** dismantle under pressure.
- **Never** dismantle when it is hot.

Operation

- **Never** dismantle under pressure.
- **Never** dismantle when it is hot.
- **Always** read the technical data thoroughly.
- **Never** touch when processing hot liquids.
- **Always** rinse well with clean water after the cleaning.

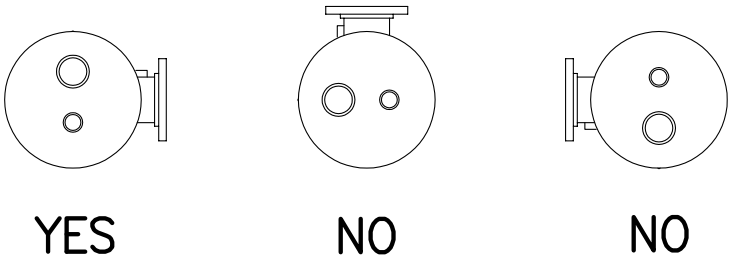
Maintenance

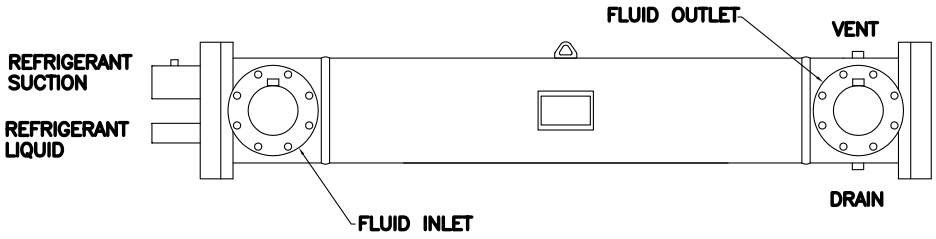
- **Always** read the technical data thoroughly.
- **Never** service when it is hot.
- **Never** service under pressure.

Evaporator Installation Recommendations

There are many steps involved in installing a new evaporator. Following proper procedures will help ensure a long trouble free service life for the evaporator. This document is an outline of steps that should be followed; however they are not a substitute for proper training or experience.

1. Inspect the evaporator. Any damage should be reported to the shipping company immediately. This is your responsibility. As with any shipping damage, it is advisable to take a picture of any damage.
2. Use the lifting lug(s) to position the barrel to avoid damaging the insulation. Addition layers or thicker insulation should be used if the unit will be exposed to temperatures in excess of 95°F and 70% relative humidity, or when the leaving fluid temperature is 32°F or lower. If the unit is installed where the ambient temperature can drop below the freezing point of the shell-side fluid, a heat tape sufficient to keep the shell-side fluid from freezing must be installed under the barrel insulation.
3. Stock evaporators are normally equipped with shell side fluid nozzles on the right hand side (when viewed from the refrigerant connection end). Right hand units can be converted to left hand units by removing and switching heads (see Evaporator Gasket Replacement Procedure section for more details). Top mounted fluid nozzle evaporators must be ordered from the factory. **CAUTION:** Do not install the evaporator rolled over on its side or upside down. The evaporator will not function properly if it is rolled over 90° on its side, or 180° (upside down, with the suction nozzles below the liquid nozzles). See diagram below for more details.





4. The fluid inlet nozzle must be at the end adjacent to the refrigerant connections to assure refrigerant superheat for proper operation of the thermostatic expansion valve.
5. Locate the unit allowing adequate room to remove the heads should service ever be necessary. The unit should be within 2 degrees of level and bolted or welded in place.
6. Fluid side piping should be done in accordance with local codes. Remove plastic plugs that are placed in the pipe couplings on the shell and install steel pipe plugs. A high quality Teflon based pipe dope is recommended for sealing fluid side pipe threads. **CAUTION:** Use care removing these plastic plugs, as there are tubes very close to the outside of the shell. Poking a screwdriver or an awl through the plug could damage a tube. The same is true if you need to re-tap one of the couplings; threading the tap in too deeply will damage tubes possibly causing a leak.

7. A filter or strainer must be installed on the evaporator fluid inlet if you have silt, particles or other foreign debris in your fluid. This debris can accumulate in or block fluid flow through the tubes and will result in excessive pressure drop with localized areas of high fluid velocity. You also risk freezing the unit since pockets of stagnant fluid will accumulate in the unit. Filters and strainers must be maintained on a regular basis. Upstream filters are recommended for any unit to extend the service life of the unit.
8. All new piping must be flushed before being connected to the evaporator.
9. A flow switch should be installed in the 3/4" NPTF coupling on the fluid outlet flange or in the outlet pipe immediately after the flange. Provisions may be made to install wells in the outlet piping for a freezestat and temperature control sensors (if the leaving fluid is being used for compressor control). Always use new gaskets on flanges and clean flange sealing surfaces.
10. Install the expansion valve or a tee connector if you are using a hot gas bypass valve (Sporlan sells a fitting designed for this) to into the liquid line fitting. Wrap the expansion valve with a flame barrier to protect it while soldering. Use a nitrogen flood and wet wrap a rag around the steel liquid fitting to protect the insulation from scorching and the head gasket from excessive heat.
11. Solder the sight glass into the liquid line, using a nitrogen flood and a flame barrier to protect the element.
12. Solder the liquid line solenoid valve in place, using a nitrogen flood and a flame barrier to protect the internal components. The solenoid valve should be installed in accordance to the manufacturer's specifications. Ensure that fluid flow will go in the correct direction through the valve.
13. Solder the liquid line dryer in place using a nitrogen flood and flame barrier at both ends. Complete high side piping with connection to condenser outlet.
14. Solder the suction line into the suction fitting, using a nitrogen flood and a flame barrier to protect the insulation from scorching and the head gasket from excessive heat. See suction line guidelines.
15. Connect the expansion valve and hot gas bypass valve equalizer line(s) (if used). This can be done by brazing the line directly to a hole punched in the suction line or using the connection that we install on the steel suction fitting. This should only be done after all brazing is done. If you are going to do this you will need to thread a 1/4" NPT to 1/4" SAE, adapter into the coupling welded to the steel suction fitting. If the adapter does not thread in easily the coupling should be cleaned out with a 1/4" NPT tap and all shavings should be removed. We recommend using a high quality sealant such as Loctite 554 on the pipe threads. Be sure to remove any Schrader pins from the 1/4" SAE fitting, unless the equalization line connector is fitted with a depressor.
16. Attach the expansion valve bulb or equivalent to the suction line. Follow the equipment manufacturer's instructions for more details.
17. A suction line dryer can be installed at this time and is very helpful after a compressor burnout. We do recommend that the core be removed after 24 hours if the sight glass indicates no moisture and if an acid test shows that the oil condition is satisfactory. Leaving the core in can cause problems later if the pressure drop across the dryer gets too high.
18. Once the entire system has been leak checked you can evacuate it, charge it and adjust all settings and controls.

WARNING! Do not exceed the shell side or tube side design working pressures and temperatures stamped into the nameplate. Never remove the nameplate from the shell.

WARNING! Never use air-refrigerant mixtures for leak testing. Under certain conditions some refrigerant-air mixtures become flammable.

CAUTION: During any pressure testing do not exceed the MAWP (maximum allowable working pressure) displayed on the nameplate.

DX Evaporator Materials of Construction

Component	Default Material	Alternative 1	Alternative 2
Tubes	Copper	Carbon Steel	Stainless Steel
Header	Carbon Steel	Stainless Steel	-
Shell	Carbon Steel	Stainless Steel	-
Tube Sheet	Carbon Steel	Stainless Steel	-
Baffles	Carbon Steel	Stainless Steel	Plastic

Fluid Quality and Velocity

Poor fluid quality can foul a unit to a point where there is a significant reduction in performance or drastically reduced service life. Corrosive water can attack and destroy the baffles inside a unit; this can cause an 80- 90% reduction in performance. Highly corrosive water can also attack the copper tubes creating cross fluid to refrigerant leaks. We recommend that you take a sample of the fluid to be run through the unit and have a local laboratory run the Langelier and Ryznar indexes. These are simple tests which will give you an idea of the condition of your fluid. For further information we recommend that you contact a local water treatment professional.

Excessive fluid velocity will reduce the service life of an evaporator. When you have started the unit you should verify that there is adequate fluid flow for proper operation, and that the fluid flow rate does not exceed the values published in our catalog for your particular model. The best way to verify proper flow rate is to use a flow meter. If a clamp-on flow meter is not available for startup testing, or some type of flow meter cannot be permanently installed in the fluid line, you can use the fluid pressure drop across the evaporator as an indication of flow rate. When the unit is first installed, it is the best time to check pressure drop since the pressure drop will rise slightly as the unit accumulates the normal amount of fouling, which is acceptable and expected. Too high of a pressure drop is an indication of excessive fluid flow or velocity through the unit. This will cause excessive wear on the tubes and can result in premature tube failure. Too low of a pressure drop is an indication of too little fluid flow. This will cause poor and erratic system performance.

Recommended Water Quality for Copper

pH	$7.5 \geq X \leq 9.0$	pH
SO_4^{--}	< 100	ppm
HCO_3^-/SO_4^{--}	> 1.0	ppm
Total Hardness	$4.5 \geq X \leq 8.5$	dH
Cl-	< 50	ppm
PO_4^{3-}	< 2.0	ppm
NH3	< 0.5	ppm
Free Chlorine	< 0.5	ppm
Fe^{3+}	< 0.5	ppm
Mn^{++}	< 0.05	ppm
CO_2	< 50	ppm
H_2S	< 50	ppb
Temperature	< 150 (65)	°F (°C)
Oxygen Content	< 0.1	ppm

Control Setting Notes

Every year many evaporators are needlessly frozen. Freeze-ups can be prevented with properly installed and adjusted controls that are protected from tampering. The two most important controls are the low pressure cut out and the flow switch, both of which should be set up to shut off the compressor should they be tripped. They can be either manual or automatic reset. The low pressure cut out should be set to trip at a pressure corresponding to the refrigerant saturation temperature slightly above the freezing point of the fluid being circulated through the evaporator. For example, a system using R-22 and straight water should be set at 58-59 PSI. This pressure corresponds to 32-33°F. You can go to lower settings to minimize nuisance trips, but, this does risk freezing the unit up. The flow switch should be adjusted so that it will trip not only when fluid flow stops completely, but, when it drops off significantly. A freezestat can be used, however, with the compact high performance TX line of evaporators there is a much smaller volume of fluid in the evaporator, and for the example above, the freezestat must be set at 39°F. The best protection is still the low pressure and flow switches. Always verify settings with a calibrated set of gauges through several cycles. Remember to account for glide with blends such as R-407C & R-409A. If using gauge pressure (which most refrigerant gauge sets do), be sure to correct the pressure setting for the local atmospheric pressure.

Suction Line Guideline

Suction line sizing: This is very important. If suction line diameter is too small you will see excessive pressure drops which can cause a reduction in performance and inadequate compressor cooling. Too large of a diameter can reduce velocities enough that the oil will not remain entrained with the refrigerant and can cause oil to build up in the evaporator and suction line. Ensure that the velocity is kept under the recommended limit shown in Chapter 1 of the ASHRAE Refrigeration handbook at the normal design conditions. Keep the suction line as short and straight as possible and use as few elbows as possible, use long radius elbows where space permits. This will minimize pressure drop and enhance performance. NOTE: Suction lines should always be insulated.

Oil traps: P-traps are made up with copper elbows and ells to help keep the oil mixed with the refrigerant as it travels to the compressor. Traps may not be necessary when the compressor is mounted below or level with the evaporator, unless you do not have pumpdown control. In that case you should have an inverted trap to prevent oil from draining into the compressor during the off cycle. Simply pitching the suction line towards the compressor should be adequate when the compressor and evaporator are mounted at the same level. A P-trap should be installed at the base of any suction line with a vertical rise. In long runs a P-trap should be installed for every 20 feet of vertical rise and every 30 feet of horizontal run.

Suction accumulators: P-traps will not prevent large amounts of oil or liquid refrigerant from slugging the compressor. Systems that are prone to liquid damage such as commercial and low temperature systems should use a suction accumulator. This will prevent flood-back, slugging and enhance oil return. The accumulator should be installed at the same level as the compressor.

Suction line heat exchangers: These use the suction gas to sub-cool the liquid refrigerant, boil off any liquid in the suction, line and add superheat. This increases system performance and adds a measure of protection for the compressor.

For further information, refer to the ASHRAE Refrigeration Volume, Chapter 1.

Soldering/Brazing Guidelines

Only air conditioning and refrigeration tubing that is plugged and dehydrated should be used for piping the system.

Always use a torch tip that is large enough to bring the metal being soldered up to the appropriate temperature quickly to prevent overheating the work piece.

Whenever possible the component being soldered should be disassembled. This is especially important on ball valves, as the seats in these valves are prone to damage from overheating and most are easily disassembled and reassembled.

Always clean both pieces being brazed with a sand paper or a wire brush.

Copper to steel joints: You must use a solder with no less than 45% silver content and the corresponding flux.

Copper to copper joint: Solder with no less than 15% silver content is recommended. Solders with a lower silver content can be used if necessary, but are not recommended.

Nitrogen flood: The system should be flooded with nitrogen when soldering to prevent the formation of oxidation on the inside of the copper tubing being brazed. This is done by filling the system with nitrogen and then setting the regulator at 2-4 pounds and letting it flow while you are brazing. There should be an opening large enough to prevent pressure from building up in the system.

Wipe the joints clean with a flame barrier once brazing is complete. Always pressure test with nitrogen when brazing is completed, 150 PSIG is recommended for testing.

WARNING! Ensure all of the systems components and relief valves are rated for at least that pressure. Test all joints with a leak detection fluid.

Welding Repair Notes

If the unit is still under warranty, please consult with the factory before performing any repair work. Any work performed without the approval of Alfa Laval Standard will void any remaining warranty.

If a weld repair is necessary on an evaporator you must determine what type of unit it is since different rules apply.

UL: These are smaller units and can be identified by an adhesive label that says "built" in the upper right hand corner followed by a nine digit serial number. You can weld on these as necessary. It is your responsibility to use proper procedures and a qualified welder. You accept full liability for any of these repairs and any resulting damage will void any remaining warranty.

UM & U: These are medium and larger units identified by a steel tag welded to the unit. UM units have a UM symbol in the upper left corner of the tag and says "MFR. SER. No." followed by a six character serial number with the first being an letter and the remaining five being numbers, across the top. U units have a U symbol in the upper left corner and say "MFR. SER. & NAT'L BD. NO." followed by a six digit number across the top. Any welding done on either of these units must be done by an ASME certified welder that holds an “R” stamp, following proper procedures. An R- 1 form must be completed. Welding by an unauthorized welder or removal of the steel tag voids the warranty and the vessel's certification with the National Board. Any damage caused by unauthorized welding will void the warranty.

Evaporator Cleaning Information

Evaporators can build up deposits on the tubes, baffles and sediment inside the evaporator. This can lead to a complete or partial blockage which often results in freeze-ups and dramatically reduced performance. It is crucial to maintain fluid quality and keep scale and sediment from accumulating in the unit. Below are guidelines on how to keep the unit clean and how to clean the unit if it becomes dirty.

Fluid Quality

Fluid quality is a complex issue that is best handled by a professional who specializes in water treatment. Poor quality fluid can cause corrosion on the inside of the tubesheets, shell and baffles. Corrosion on the tubesheets can lead to leaks through the tube joints. It can also corrode the shell, perforating it in extreme cases. When the baffles are attacked they no longer direct the fluid flow and allow it to pass through the unit too quickly, resulting in a serious loss of performance. Once a unit is this badly damaged it cannot be repaired. This damage is not reversible, and may require replacement of the unit. **CAUTION:** Damage caused by poor fluid quality is not covered under our warranty. Poor quality fluid can also lead to tube failure and subsequent system damage.

Scale

Excessive hard scale which forms on the tubes will act as an insulator and inhibit heat transfer, reducing performance and increasing utility costs. This is caused by hard water with high mineral content. Some scale build up is normal and this will help protect the tubes. There are formulated descaling products such as RYDLYME, which are not as harsh as using acid. When using any descaling product follow the manufacturer’s instructions.

CAUTION: Running acid through the system is not recommended and will void the unit’s warranty.

Sediment

Sediment can cause a loss of performance and freeze-ups. When sediment builds up it restricts fluid flow through the tube bundle. The way to prevent this is to install a strainer or filter the inlet of the evaporator. If the fluid is exposed to airborne particulates, heavy rust or any other source of sediment, you must clean the screen or filter as needed to ensure full fluid flow through the barrel. Blocked filters increase the risk of fouling and can dramatically reduce the performance and service life of the unit, due to the lower velocity of the fluid. To remove accumulated sediment, back flush the unit by reversing the fluid flow through the unit. To improve the results of this procedure inject low pressure air (25-50 PSIG) through a nozzle into the 3/4" NPTF coupling on the flange that the fluid is being pumped through, this will help agitate the sediment.

Flow Switches & Fluid Velocity

It is crucial that a flow switch is installed on the evaporator fluid outlet and inspected for function on a regular basis. It is also important that fluid velocity through the evaporator remains below 5 ft/s, as higher velocities can result in tube failure. If you are unsure of the velocity, please contact the factory or use the ProSuite software to calculate the velocity of the fluid flow by providing the GPM.

Evaporator Refrigerant Loss

Refrigerant loss can occur in a number of different ways and can be caused by several different issues. Care must be taken not to circulate fluids in excess of the maximum allowable refrigerant temperature through the shell side of the evaporator, since the corresponding refrigerant pressures may exceed the tube side working pressure. Consult the nameplate to determine the maximum working pressure. Under such conditions, gasket “blowout” can occur along with tubesheet and head distortion. Also, abnormal thermal expansion and contraction of the different materials used in the evaporator can also cause similar gasket “blowout” or damage to the tubes, tubesheets and or heads. Other causes of gasket leaks include excessive bolt load, due to over tightening, which may crush the gasket and create excessive bow in the tube sheet or head.

Evaporator Tube Leak Test Procedure

If you suspect you have a leaking tube or tubes in an evaporator you need to verify it. Electronic leak detectors can be used to sense the presence of a leak, but you need to pinpoint the leaks exact location. To do this you can use the procedure below.

1. Shut off the system and ensure the recovery of all refrigerant. Ensure the vessel has been isolated from the rest of the system.
2. Remove evaporator heads; see evaporator gasket replacement procedure.
3. Shut off fluid to evaporator, drain fluid side of vessel, close the valves and go to step 4. If there are no valves you will have to split the flanges and install blank flanges.
4. Pressurize the shell with nitrogen to 150 PSIG. NOTE: YOU MUST VERIFY THAT EVERY PART OF THE SYSTEM EXPOSED TO PRESSURE IS RATED TO SAFELY HANDLE THAT PRESSURE, INCLUDING THE EVAPORATOR, PIPING, VALVES, BLANK FLANGES, RELIEF VALVES, AIR BLEEDS, ETC.. Start by leak checking the tube to tubesheet joints by spraying or brushing a leak detecting soap solution on the tubesheet. Let the bubbles that form when applying pop, and then look for a thick white froth around the outside diameter of each tube, this indicates a leak. After an hour verify that you still have 150 PSIG, reapply soap, recheck, if no leaks are found go to step 5.
5. There are three methods for checking leaks inside of the tubes. All of these should be done while the pressure applied in step 4 is still on the shell.
    a. For this method you will need a bubbler. This is easily made by drilling a hole in an appropriate size rubber plug, insert a tube through the hole and insert the other end into a clear glass jar half filled with water. Plug the tubes at one end with rubber plugs and insert the bubbler into each tube at the other end individually and observe the jar for bubbles for 20-30 seconds on each tube. A leaking tube will produce bubbles in the jar. This is the simplest method.

b. Plug the tubes at one end with rubber plugs and form bubbles at the other end using a leak reactant. Watch for bubbles that rapidly expand and pop. It is best to leave the unit open for several hours since any remaining refrigerant laden oil will give false indications as the refrigerant boils.

c. Plug both ends of the tubes and let the unit sit for at least 12 hours; leaking tubes will pop one of the plugs out.

6. If leaks are found and the unit is still under warranty, contact Alfa Laval Standard before performing any repairs. Unauthorized repairs will void any remaining warranty. You must also take corrective action to eliminate the conditions that caused the failure. Bulges or blisters on the inside of tubes are caused by ice that formed when the suction pressure drops below the freezing point of the fluid.

WARNING! Never use air-refrigerant mixtures for leak testing. Under certain conditions, some refrigerant-air mixtures become flammable.

CAUTION: During any pressure testing do not exceed the MAWP (maximum allowable working pressure) displayed on the nameplate.

Field Evaporator Gasket Leak Test Procedure

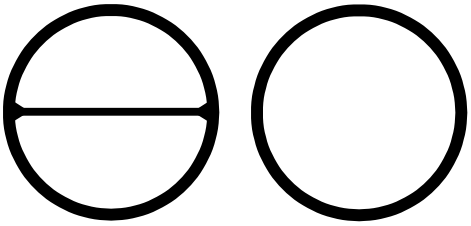
If you suspect that you have leaking evaporator gaskets this must be verified by testing the unit. The steps to check for cross-circuit or external gasket leaks are listed below.

1. Shut off the system and ensure the recovery of all refrigerant. The liquid and suction lines must be sealed to isolate the evaporator. The liquid line solenoids will not seal the liquid lines. Close the suction valves at the compressor.
2. Install 1/4" SAE fittings (without cores) into the 1/4" pipe thread couplings on the suction fittings. This allows you to use your gauge manifold.
3. Pressure all circuits to 150 PSIG with nitrogen or carbon dioxide. Using a leak reactant, brush or spray a liberal amount over the entire outside of the gasket and check for indications of a leak. If no leaks are found and you are working on a single circuit unit you are done. If you are working on a multi-circuit unit move onto the next step. If a leak is found move onto step 5.
4. On multi-circuit units you can now check for cross-circuit leaks. Pressurize the first circuit to 150 PSIG. Place a hose over the flare fitting on the second circuit (two circuits) and place the other end into a small jar of water. Watch the jar for bubbles for five minutes. If you are working on a two circuit model, reverse the connections (i.e. pressurize circuit 2 and check circuit 1). If a gasket has been blown out by higher pressure in circuit 2, pressurizing only circuit 1 may push the gasket back into place sufficiently to conceal the leak. If a leak of this nature is found, re-torqueing the bolts will not fix the problem, the gasket must be removed and replaced. On three and four circuit units you must pressurize each circuit and check adjacent circuits. In other words, on a four circuit unit, you would pressurize circuit #1 and check #2. Pressurize circuit #2 and check circuits #1 & #3. Pressurize circuit #3 and check circuits #2 & #4. Do this until each circuit has been pressurized. If no leaks are found you may put the unit back into service. If you do find a leak see step 5. If you cannot find a hose and a jar you can form a soap bubble on the opening of the fittings and see if it grows and pops. If it is not leaking the bubble will collapse or it will not grow. Be careful not to get excessive amount of soap in the fitting. NOTE: Refrigerant laden oil can give a false leak indication as the unit warms and the refrigerant begins to boil out of the oil and expand. If the unit is used you may want to let it sit for 24 hours or until the residual refrigerant boils off. If no leaks are found you may put the unit back into service. If you are confident that you have a leak see step 5.
5. If you verify a leak you should re-torque the bolts to the correct torque and retest. If this does not stop the leak you can raise the torque by 10 foot/pounds and retest. If you still have a leak you must replace the gaskets. Contact Alfa Laval Standard for gaskets and the appropriate procedure. Only gaskets supplied by Alfa Laval Standard should be used, since other materials may not be compatible with all refrigerants and oils.

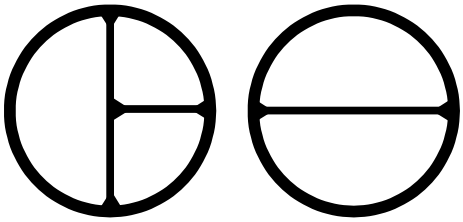
CAUTION: During any pressure testing do not exceed the MAWP (maximum allowable working pressure) displayed on the nameplate.

Evaporator Gasket Layouts Examples

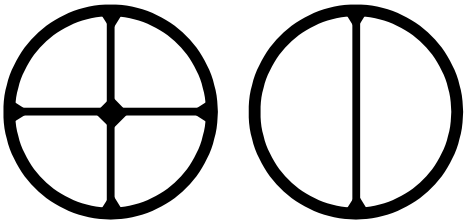
Gasket A
Single Circuit — Dual Pass



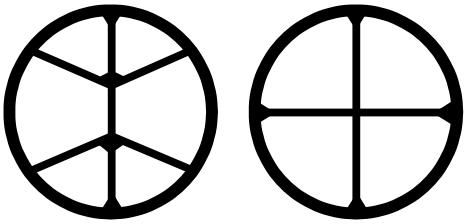
Gasket B
Single Circuit — Four Pass



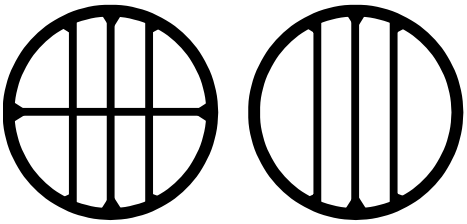
Gasket C
Dual Circuit — Dual Pass



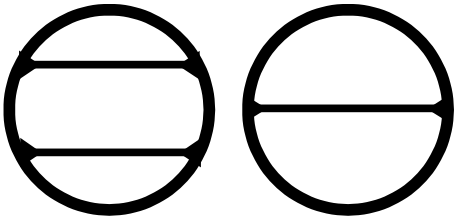
Gasket D
Dual Circuit — Four Pass



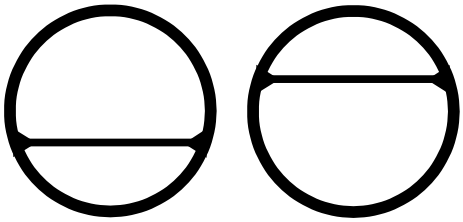
Gasket E
Quad Circuit — Dual Pass



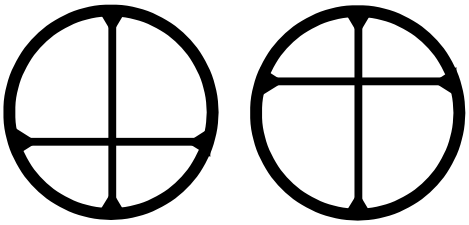
Gasket F
Single Circuit — Four Pass



Gasket G
Single Circuit — Three Pass



Gasket H
Dual Circuit — Three Pass



Evaporator Gasket Cutting Procedure

Contact Alfa Laval Standard for the correct gasket or gasket sheet material.

There are times when you will need to cut a gasket by hand from sheet material. The gasket material used at Alfa Laval Standard is compatible with the refrigerants that are approved for the particular evaporator and refrigerant oils and is available in 1/8”, 3/16" & 1/4". Follow the procedure below to hand cut a gasket. Contact the factory for gaskets for units with grooved heads or tubesheets.

1. Cut a disc from suitable material. To obtain the dimensions for this disc you can use the old gasket, if it is in usable condition. If not, you will have to measure on the inside of the head, move 1/4" from the inside of one bolt hole, measure 180 degrees across to the same point on another bolt hole. This is your diameter which must be transferred to a sheet, do this using a large compass. If you do not have a compass, you can make one using a ruler, yardstick, or a straight edge. Take a ball point pen and a white paint marker, tape them to the yard stick and use this as your compass. Center the ball point pen and mark your diameter with the paint marker. Two ball point pens can be used if necessary, but lines are much harder to see.
2. Lay material on flat clean surface; a piece of cardboard on a bench or the floor works well. Using a utility knife with a new blade, make your first cut along the outside diameter mark you have laid out, using light pressure. Follow along the same line, on the second cut the blade will pass through 1/8” thick material, 3/16" will take 3 cuts and 1/4" will take 4 cuts. Work your way around the disc cutting 1/4 of the diameter at a time. **CAUTION:** Don't use a hacksaw to cut the gasket, as this can result in contaminate inside the exchanger.
3. Once you have a disc you must now lay out the partition webs, if you have a gasket in good condition you can lay it on top of your disc and trace the webs with the paint marker. If you do not have a usable gasket there are two alternatives to transferring the pattern to the disc.
    a. In the first method, put a good coat of oil on the head and then holding the gasket very tightly at one edge roll it down over the head and press on the backside of the gasket. Peel the gasket back up without allowing it to slip and you will have a pattern to cut along.
    b. In the second method you again hold the gasket, but now you push firmly on the back of the gasket with your thumbs along the inside diameter of the head and on both sides of the partitions. In both cases you must make sure that the disc does not slip while you are getting the pattern, the lines must be clear before you start cutting. Always make sure that you keep the disc centered when patterning. Both methods can be done with the head in a vertical position, but, are much easier to do with the head lying flat, and should be done with two people.
4. Once you have your pattern cut out the sections of the gasket. Follow the directions in step 2. The difference being when you come to the corners be very careful, one slip and you will have to start over. **NOTE:** Always cut away from the corners.

Evaporator Gasket Replacement Procedure

1. Ensure that all refrigerant has been recovered and that the vessel has been isolated. There is no need to drain the barrel.
2. Carefully remove any insulation to expose bolt heads. Cut carefully and mark position of insulation so that it can be reused.
3. Cut or un-sweat liquid and suction lines as necessary for removal of heads. Measure line sizes and get slip couplings.
4. Put witness marks at 12 o'clock on the tubesheet and on the head to ensure proper alignment during reassembly. Support head and remove all but two bolts, carefully remove final two bolts, be careful that head does not slip down or swing out.

WARNING! HEADS ARE VERY HEAVY, HANDLE WITH EXTREME CARE!

5. Once head is secured where you can safely work on it, peel off the old gasket. Scrape the remaining gasket material and adhesive from the head, be careful not to scratch or gouge the head. Clean gasket surfaces on the head and tubesheet with a solvent cleaner. Clean gasket with solvent until the surface is shiny black, allow the gasket to dry.
6. After that you ensure that you have the correct gaskets, apply a thin (0.010" to 0.015") uniform coat of adhesive to the head and one side only of the gasket.
7. Carefully place gasket on head. This is best done with two people since the gasket should not be moved once it has been placed. Ensure that the gasket's webs are centered on the partitions. Allow the adhesive to cure for at least one full hour. Cut out unused dividers from the gasket after curing.
8. Guide the head into place (remember to put couplings on liquid and suction lines). Be careful not to disturb gasket. Tighten bolts until gasket is just touching the tubesheet all the way around.
9. Torque bolts in a crisscross pattern to step 1, then to step 2 and finally to step 3 (if applicable, see chart). Torque to the final value once more. **CAUTION:** DO NOT TIGHTEN THE BOLTS ANY FURTHER!
10. Re-braze all connections, use 45% or higher silver content solder and the proper flux for steel to copper joints and 15% for copper to copper. Charge evaporator to 150 PSIG with nitrogen and check for leaks using a leak reactant. If a gasket leak is found, torque the bolts 10 ft/lbs. higher and recheck. Evacuate to 1500 microns, break the vacuum with nitrogen and evacuate to 500 microns. You can now recharge and start the evaporator.
11. Reinsulate all affected areas.

WARNING! Never use air-refrigerant mixtures for leak testing. Under certain conditions, some refrigerant-air mixtures become flammable.

Evaporator Gasket Replacement Procedure for Grooved Heads/Tubesheets

1. Ensure that all refrigerant has been recovered and that the vessel has been isolated. There is no need to drain the barrel.
2. Carefully remove insulation to expose bolt heads. Cut carefully and mark position of insulation so that it can be reused.
3. Cut or un-sweat liquid and suction lines as necessary for removal of heads. Measure line sizes and get slip couplings.
4. Put witness marks at 12 o'clock on the tubesheet and on the head to ensure proper alignment during reassembly. Support head and remove all but two bolts, carefully remove the final two bolts, but be careful that head does not slip down or swing out.

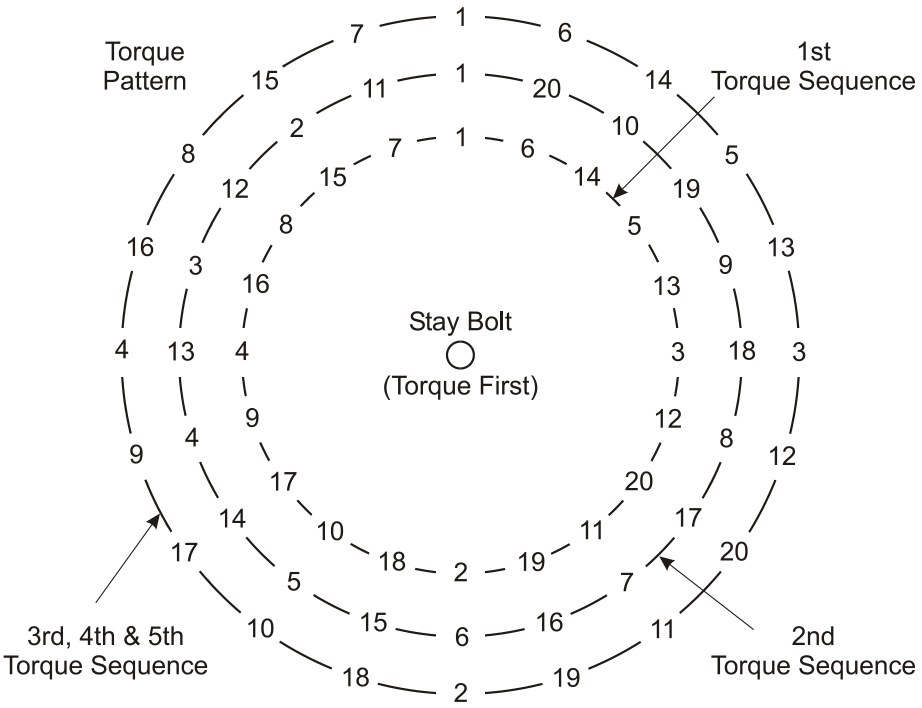
WARNING! HEADS ARE VERY HEAVY, HANDLE WITH EXTREME CARE!

5. Once head is secured where you can safely work on it, peel off old gasket. Scrape the remaining adhesive from the head, be careful not to scratch or gouge head. Remaining adhesive can be removed using a solvent cleaner. On TX25s and smaller only use solvent. Clean tubesheet with brake cleaner. Clean gasket with solvent until the surface is shiny black, allow all surfaces to dry.
6. Verify that you have the correct gaskets. Cut out any unused gasket dividers, cut along the lines of the webs and the inside diameter of the gasket so there is no overhang on the groove. Apply a thin (0.010" to 0.015") uniform coat of adhesive in the groove of the head and one side of the gasket. Carefully place the gasket into the groove, start from the outside at the top and bottom and work towards the center, then the partitions on the side. Once the gasket is in place run a small flat blade screwdriver between the wall of the groove and the gasket to make sure that the gasket is seated in the groove. If the gasket is not fully seated it will probably leak. Allow adhesive to cure at least one full hour.
7. Guide the head into place and align the witness mark on the head with the witness mark on the tubesheet, this is critical and the head must remain aligned and fully supported until all bolts are completely tightened. Be careful not to disturb gasket. Tighten bolts until gasket is just touching the tubesheet all the way around. Torque bolts in a crisscross pattern to step 1, then step 2 and step 3, (if applicable, see chart). Torque once more to the final value once more. **CAUTION:** DO NOT TIGHTEN BOLTS ANY FURTHER!
8. Re-braze all connections. Charge evaporator to 150 PSIG with nitrogen and check for leaks using a leak reactant such. If a gasket leak is found, torque the bolts 10 ft/lbs. higher and recheck. Evacuate to 1500 microns, break the vacuum with nitrogen and evacuate to 500 microns. You can now recharge and start the evaporator. Reinsulate, you can use the left over adhesive for this.

WARNING! Never use air-refrigerant mixtures for leak testing. Under certain conditions, some refrigerant-air mixtures become flammable.

CAUTION: During any pressure testing do not exceed the MAWP (maximum allowable working pressure) displayed on the nameplate.

Evaporator Torque Chart



There are numerous bolt patterns used on our evaporators. Illustrated above is the torque sequence of a 20 bolt head. If the unit that you are working on does not match use the written instructions below.

1. Start at a top bolt or 12 o'clock and torque bolt.
2. Move 180 degrees to a bottom bolt or 6 o'clock and torque bolt.
3. Move 90 degrees to a bolt at 9 o'clock and torque bolt.
4. Move 180 degrees to a bolt at 3 o'clock and torque bolt.
5. Go back to the top and move clockwise one bolt and start the sequence over. Continue using the steps outlined above, using the torque steps listed in the chart.

Evaporator Head Torque information

Bolt Diameter	Wrench Size	Torque Step 1*	Torque Step 2*	Torque Steps 3, 4 & 5*
1/4”	3/16” Allen	5	10	N/A
3/8”	5/16” Allen 9/16” Hex	15	30	N/A
1/2”	3/4” Hex 7/8” Hex**	30	50	70
5/8”	15/16” Hex 1-1/16” Hex**	35	70	120
3/4”	1-1/8” Hex 1-1/4” Hex**	40	90	140
7/8"	2-3/8	50	100	160

*All torque values are expressed in foot pounds

**Units designed for low temperature operation (-20°F and below) will use B7 or B7M bolts. These bolts have larger heads.

Condenser Installation Guidelines

There are many steps in installing a fluid cooled condenser. Following the proper procedures will ensure a long trouble free service life for the condenser. Below is an outline of steps that should be followed. These steps are recommendations only and not a substitute for proper training and experience.

1. Inspect the condenser. Any damage should be reported to the shipping company immediately. This is your responsibility. As with any shipping damage it is advisable to take a picture of any damage.
2. Install the condenser using our universal brackets or factory installed brackets. Condensers should always be securely mounted.
3. Refrigerant lines should be sized and routed to meet system capacity requirements, pressure drop requirements and proper refrigerant velocity to ensure no oil return to the compressor. Chapter 1 Halocarbon Refrigeration Systems in the ASHRAE Refrigeration Handbook provides an excellent guide for refrigeration piping practice. Pipe up the refrigerant side of the condenser, use a solder with 45% or higher silver content and the proper flux for copper-to-steel joints. In some cases it will be necessary to install a vibration isolator in the refrigerant inlet line to insulate the condenser from compressor vibration; a discharge muffler is advisable when the condenser is very close to the compressor. Use a nitrogen flood to prevent the formation of oxidation on the inside of the copper lines and steel fittings while brazing. This is done by filling the unit with nitrogen and setting the regulator as 2-4 PSIG and letting it flow while you are brazing. There must be an opening to prevent pressure from building up inside the unit.
4. Install a relief valve in the fitting provided. Verify the rating on the valve is not higher than the maximum allowable working pressure (MAWP) specified on our tag. A quality sealant such as Loctite 554 or equivalent should be used to seal the relief valve and any other pipe thread joints on the refrigerant side of the unit.
5. Pressure test all of the refrigerant connections by pressurizing the condenser to 150 PSIG and applying a leak reactant. Evacuate the condenser.
6. Fluid side piping should be done in accordance with local codes. Size the piping to ensure that the fluid side velocity does not exceed the published maximum velocities, see Fluid Quality & Velocity table. Pipe the fluid side using unions; this enables easier removal of the heads if the unit needs to be cleaned in the future. Dielectric unions should be installed if galvanic corrosion is a concern. The fluid regulating valve should be carefully sized and must be installed on the inlet side to prevent water hammer which can cause damaging vibrations and shorten the life of the condenser. A high quality Teflon-based pipe dope is recommended for all fluid connections. If you have fluid leaks at the gaskets ensure all of the bolts are tight, as these can come loose during shipping. Follow torque settings in the condenser head bolt torque tables.
7. When you have started the unit you should verify that there is adequate fluid flow for proper operation, and that the fluid flow rate does not exceed the values published in our catalog for your particular model. The surest way to verify proper flow rate is to use a flow meter. If a clamp-on flow meter is not available for startup testing, or some type of flow meter cannot be permanently installed in the water line, you can use the fluid pressure drop across the condenser as an indication of flow rate.
8. Make sure that you are not sending any abrasives such as sand or silt through the unit; this is particularly a concern when you are using river water or in shallow water marine applications. Install or maintain a filter or strainer if debris or sediment is a problem. Also ensure that you are not entraining air or gas in the fluid inlet at the pickup point, this will cause cavitation which will lead to premature failure and void the warranty.
9. If you have followed the above mentioned guidelines, the condenser makes a rattling noise when you start the unit, the source of the vibration is probably the fluid side. You may need to install vibration dampeners in the fluid piping.

WARNING! Never use air-refrigerant mixtures for leak testing. Under certain conditions some refrigerant-air mixtures become flammable.

CAUTION: During any pressure testing do not exceed the MAWP (maximum allowable working pressure) displayed on the nameplate.

Selection Guidelines

There are many things to consider when selecting a condenser. Criteria such as performance and pumpdown capacity are covered in our condenser catalogs. Below are factors that affect longevity.

Size: The use of too small of a condenser will force you to run an excessive amount of fluid through it to maintain head pressure. This will cause premature failure though impingement corrosion or cavitation. The small amount of money that you may save by buying a smaller condenser will be lost since damage caused by impingement corrosion is not covered under warranty.

Material: Few applications have ideal fluids. Tower systems can be treated. If you are using city, well, or river water you cannot economically treat your water and if the fluid quality is poor you can quickly damage a unit. We recommend the Langelier and Ryznar indexes to assess your fluid quality. These are simple tests that can be done by a local laboratory at a reasonable cost. Give them a sample of the fluid that will be run through the unit. This will give you an idea if your fluid is corrosive, balanced or scale forming and help you decide if you need to treat your fluid or go to a cupronickel or stainless steel unit. Damage to a misapplied unit is not covered under warranty.

Fresh Water Condenser Materials of Construction

Component	Default Material	Alternative 1	Alternative 2	Alternative 3
Tubes	Copper	Carbon Steel	Stainless Steel	90/10 CuNi
Header	Carbon Steel	Stainless Steel	90/10 CuNi	Naval Brass
Shell	Carbon Steel	Stainless Steel	-	-
Tube Sheet	Carbon Steel	Stainless Steel	90/10 CuNi	-
Tube Supports	Carbon Steel	Stainless Steel	-	-

Fluid Quality & Velocity

As mentioned in the above section fluid quality can affect the service life of a condenser. It is your responsibility to make sure that you are using fluids that are compatible with the condenser. If applicable, you must select a unit to handle harsh fluid conditions or treat the fluid. Again, as mentioned above excessive velocity will shorten the service life of a condenser. All units also run the increased risk of fouling if the fluid side velocity drops below 1.5 ft/s and low velocity in any unit will provide poor performance. All unit performance values in our catalog are within these ranges.

Tube Material	Minimum Velocity	Maximum Velocity
Copper	1.5 ft/s	8.0 ft/s
90/10 Copper Nickel Shallow Water	2.0 ft/s	7.0 ft/s
90/10 Copper Nickel Deep Water	2.0 ft/s	10.0 ft/s
Carbon Steel	2.0 ft/s	10.0 ft/s
Stainless Steel	2.0 ft/s	12.0 ft/s

Recommended Water Quality for Copper

pH	7.5 ≥ X ≤ 9.0	pH
SO_4^{--}	< 100	ppm
HCO_3^-/SO_4^{--}	> 1.0	ppm
Total Hardness	4.5 ≥ X ≤ 8.5	dH
Cl-	< 50	ppm
PO_4^{3-}	< 2.0	ppm
NH3	< 0.5	ppm
Free Chlorine	< 0.5	ppm
Fe^{3+}	< 0.5	ppm
Mn^{++}	< 0.05	ppm
CO_2	< 50	ppm
H_2S	< 50	ppb
Temperature	< 150 (65)	°F (°C)
Oxygen Content	< 0.1	ppm

Frozen Condensers

We receive many calls regarding condensers that have been frozen. This commonly occurs when a large amount of refrigerant is lost out of a condenser quickly. The most frequent cause is the relief valve opening due to excessive head pressure. This is caused by overcharging, high fluid temperature or the sudden shutdown of fluid flow to the condenser. Other causes are mistakenly removing refrigerant from an idle unit or accidental breakage of a liquid line. Pumps should be on circuits that will not be shut off while the compressor is running and lines should be protected from accidental damage. Freeze ups are also caused by not completely draining a condenser that is exposed to low ambient air temperatures. The only way to be certain that a unit is completely drained is to loosen the nuts holding the heads on and pulling the head and gasket away from the tubesheet. Simply removing a drain plug does not ensure that all of the fluid will be drained from the unit. Units that have been frozen are not covered under warranty.

Welding Repair Notes

If the unit is still under warranty, please consult with the factory before performing any repair work. Any work performed without the approval of Alfa Laval Standard will void any remaining warranty.

If a weld repair is necessary on a condenser you must determine what type of unit it is since different rules apply. You must also determine whether or not the part that you need to repair is a code part. Most condenser fluid plates are not code items and you may weld on them as necessary. The exception to this would be a "UM" or "U" condenser that has a tube side rating on the steel tag, such as our HP line of condensers. Heads on these units are code parts.

UL: These are smaller units and can be identified by an adhesive label that says "built" in the upper right corner followed by a nine digit serial number. You can weld on these as necessary. It is your responsibility to use proper procedures and a qualified welder. You accept all liability for these repairs and work causing damage to the unit will void any warranty.

UM & U: These are medium and larger units identified by a steel tag welded to the unit. The UM units have a UM symbol in the upper left corner of the tag and says "MFR. SER. NO." followed by a six character serial number with the first being a letter and the remaining five being numbers. The U units have a U symbol in the upper left corner and say "MFR. SER. & NAI'L BD. NO:' followed by a six digit number across the top. Any welding done on either of these units must be done by an ASME certified welder that holds an "R' stamp, following proper procedures. An R- 1 form must be completed. Welding by an unauthorized welder or removal of the steel tag voids the warranty and the vessel's certification with the National Board.

Condenser Cleaning Information

As condensers run, deposits accumulate in the tubes, inhibiting heat transfer. This raises head pressure and utility costs. With good fluid condensers can run for years without cleaning, however poor quality fluid can build up enough deposits to cause a drop in performance in a very short time. Below is information that will help you clean your condenser. The importance of controlling fluid quality and proper condenser maintenance cannot be overstated.

Soft deposits

Soft deposits are really biological growth in the form of mud, slime and algae resulting from the use of river water or poorly controlled tower water. This is best cleaned using a pneumatic tube cleaning gun which forces plugs down the tubes. Some have a brush between two rubber plugs and others are specially designed plugs which scrape the tube walls as they travel down the tube.

Scale

Scale is minerals that have been deposited on the inside of the tubes resulting from the use of fluid with high alkalinity. These deposits are harder to clean and require special equipment. These systems utilize a flexible shaft which rotates a brush as it is fed down the tube, they can also simultaneously flush out the tubes with fluid. There is a wide variety of brushes and tools available that attach to the shaft to clean both soft and hard deposits.

Corrosion

If you find evidence of corrosion or pitting in the tubes, on the tubesheets, or fluid plates, further investigation is required. This can be caused by poor fluid quality, or inadequate or excessive velocity. The investigation should begin by taking a fluid sample to a local lab and having them run the Langelier and Ryznar indexes. If the fluid quality is found to be bad, it should be corrected immediately and you should repair the damage to the condenser if possible. You should then check the fluid velocity through the unit. Check the flow in GPM through the unit and call us, so that we can calculate the velocity. Acceptable tube side velocities are listed in the “Fluid Velocity & Quality” section.

Acid Cleaning

CAUTION: DO NOT PERFORM ANY ACID CLEANING! If acid cleaning is not done perfectly and fully neutralized, it can do severe damage. This will also void any remaining warranty.

Condenser Tube Leak Test Procedure

If you suspect that you have a leak in a condenser you need to verify this. Electronic leak detectors cannot be used to verify a leak. Using an electronic leak detector with heavily chlorinated water will give false indications of a leak.

1. Shut off the system, turn off fluid to the condenser, and remove the fluid plates (see condenser gasket replacement procedures). Recover the refrigerant from the shell side.
2. Pressurize the shell side of the vessel with air. Place a pressure gauge on the high side of the system and check the pressure; it requires a minimum of 150 PSIG. The pressure can be raised temporarily with a heat lamp. If the unit has already been removed from the system, securely plug all fittings and pressurize with nitrogen. Once you have reached 150 PSIG start by checking the tube to tubesheet joints by spraying or brushing a leak detecting soap solution on the tubesheet. If you have corrosion on the tubesheet clean it before leak checking. Where white bubbles form indicates the location of the leak. After one hour check to see if the unit has maintained the 150 PSIG pressure, reapply the soap and test for leaks, if no leaks are found go to step 3.

3. There are three methods for checking leaks inside of the tubes. All of these should be done with the 150 PSIG still on the unit.
    a. For this method you will need a bubbler. This is easily made by drilling a hole in an appropriate size rubber plug, insert a tube through the hole and insert the other end into a clear glass jar half filled with water, ensure the end of the tube is below the water line in the jar. Plug the tubes at one end with rubber plugs and insert the bubbler into each tube at the other end individually and observe the jar for bubbles for 30 seconds on each tube. A leaking tube will produce bubbles in the jar. This is the simplest method.
    b. Plug the tubes at one end with rubber plugs and form bubbles at the other end using a leak detecting solution. Watch for bubbles that rapidly expand and pop.
    c. Plug both ends of the tubes and let the unit sit for a minimum of 12 hours; the leaking tube will pop out one of the plugs.
4. If leaks are found you must repair, replace or plug leaking tubes. You must also take corrective action to eliminate the conditions that caused the failure. Large leaks coming from inside of a tube can be an indication that the unit was frozen. This can be caused by low ambient temperature or the loss or removal of gas from the unit which lowers the refrigerant pressure below the freezing point, which freezes the fluid and ruptures the tube from the inside out.

WARNING! Never use air-refrigerant mixtures for leak testing. Under certain conditions some refrigerant-air mixtures become flammable.

CAUTION: During any pressure testing do not exceed the MAWP (maximum allowable working pressure) displayed on the nameplate.

Marine Shell & Tube Seasonal Maintenance Procedure

It is important to remember that a sea water environment is hostile and unpredictable. Waters found in Houston Harbor are not the same as those found in the Pacific Northwest. The presence of salt will accelerate the rate of deterioration of a heat exchanger. Cupronickel is used primarily to protect against that possibility. Sea water is not simply salt water. There are also particulate contaminations such as sand, mud, and dirt; there can be marine life which can end up in the tubes, die and cause highly corrosive by-products. There are numerous chemicals from processing plants present in rivers that feed into the sea. Each of these contaminants has its own effect on condensers. Sand will cause erosion of the tubes and tubesheets. This causes what is known as under-deposit corrosion. High sulfur content can cause rapid deterioration, because sulfur is highly corrosive to copper. Phosphorous compounds in sea water can cause embrittlement by combining with the nickel in cupronickel and forming nickel-phosphides. Finally, free electric current which is a common characteristic of many boats can cause condenser deterioration. To help mitigate these issues, Alfa Laval Standard has added an epoxy coat to the cupronickel tubesheets, giving tubesheet surfaces and tube joints protection against chemical attack and sand, but correct operating conditions are still required to ensure a long service life.

Sacrificial Zinc Anodes

A sacrificial zinc plate, which used to be included on all standard MS units, is no longer necessary due to advancements in Alfa Laval Standard manufacturing process. Optional zinc plates can be added between the rear gasket and the endplate or zinc plug inserts are available from the factory. NOTE: Some units with zinc plates require a different rear endplate and set of studs than units without zinc plates. If you are adding a zinc plate in the field remember to order the appropriate endplate and stud set. Check with your local sales representative or contact the factory for more details. With regular maintenance of the epoxy coating on the tubesheet, your shell and tube marine condenser should give you many, many years of fine service.

Marine Seasonal Maintenance

1. At the end of the fishing season, every six months, or whenever the condenser would stagnate for over 36 hours, fluid should be drained from the condensers. Stagnant fluid left in a heat exchanger for long periods of time can cause deoxidization of the fluid, greatly increasing the level of corrosion in any given heat exchanger.
2. Every six months or at the end of the fishing season, the tubesheets should be brushed clean. A gasket should be added to give protection for the upcoming season's activities.
3. Water plates should be put back on the condenser and torqued to 25 ft-lb on each bolt. Follow torqueing sequence shown in the diagram.

Sea Water/Marine Condenser Materials of Construction

Component	Default Material	Alternative 1	Alternative 2
Tubes	90/10 CuNi	Stainless Steel	-
Header	Naval Brass	Stainless Steel	Epoxy Coated Carbon Steel
Shell	Carbon Steel	Stainless Steel	-
Tube Sheet	90/10 CuNi	Stainless Steel	Epoxy Coated Carbon Steel
Tube Supports	Carbon Steel	Stainless Steel	-

Sea Water and Marine Water Velocity Ranges

Tube Material	Minimum Water Velocity	Maximum Water Velocity
90/10 Copper Nickel Shallow	2.0 ft/s	7.0 ft/s
90/10 Copper Nickel Deep Water	2.0 ft/s	10.0 ft/s
Stainless Steel	2.0 ft/s	10.0 ft/s

Shell & Tube Condenser Gasket Replacement Procedure

1. Before starting work ensure that you have the correct gaskets. In most cases this can be done by comparing the gaskets that you have on hand with the illustration in the appropriate catalog
2. Make sure that the fluid supply to the condenser is shut off.
3. If the unit is equipped with a drain plug in either of the heads, remove it to drain the unit and piping. NOTE: Some fluid will remain in the unit below the level of the drain plug. To remove the remaining fluid on units with no drain plugs you will have to remove the rear head to completely drain the unit. To do this remove the nuts and pull the bottom of the head away from the vessel. Use extreme care not to scratch the gasket surface, as this will cause leaks after assembly.
4. Disconnect the piping from the front head. Removing as much piping as possible will make removal and replacement of the head easier. Remove the nuts and follow the instructions in step three if the head does not come off by hand. NOTE: Some of the studs may back out when you try to remove the nuts, simply note which hole it came from and put it back in the same one during reassembly. **CAUTION:** The fluid regulating valve should always be installed on the fluid inlet to prevent water hammer.
5. The gaskets will remain on the unit. NOTE: The position of the gasket and if possible take a photograph. Use a plastic scrapper to separate the gasket from the tubesheet. Work your way around the gasket pulling it off a little at a time. Be very careful not to scratch the gasket surface on the tubesheet, as this will create leaks after reinstallation.
6. If the factory applied epoxy shows any signs of damage, corrosion or pitting on either the tubesheet or inside of the head, it should be touched up or recoated. Follow the epoxy application instructions for more details.
7. Clean the gasket surfaces, the heads and the tubesheet, to ensure that there are no particulates or scratches on any surface. Any scratches will have to be repaired before reassembling the unit.

8. Install the new gaskets over the studs. Push them on by hand a little bit at a time. **CAUTION: NEVER FORCE THEM ON WITH A HAMMER OR TOOL.**
9. Install the head and torque nuts in a crisscross pattern to values shown in the illustration.
10. Re-pipe the front head and turn fluid back on. Check for leaks after the fluid pressure has been on for at least 10 minutes. If a leak is found re-torque in the same crisscross pattern 5ft/lbs. higher.

WARNING! Never use air-refrigerant mixtures for leak testing. Under certain conditions some refrigerant-air mixtures become flammable.

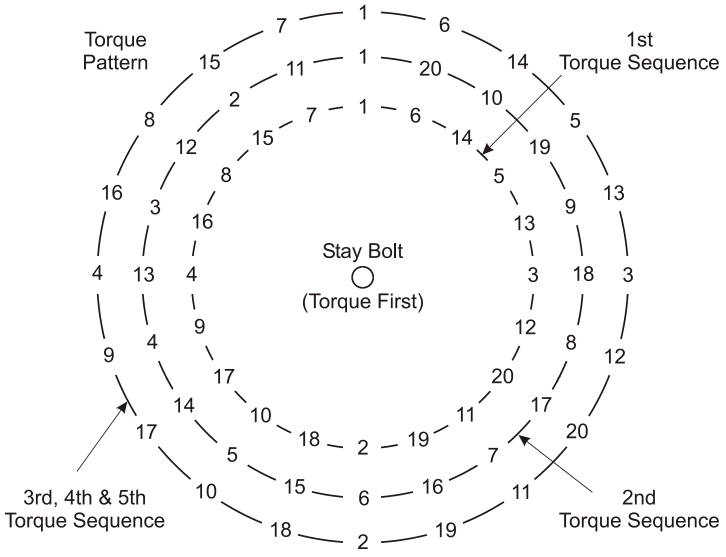
CAUTION: During any pressure testing do not exceed the MAWP (maximum allowable working pressure) displayed on the nameplate.

Condenser Endplate Torque

	Torque Step 1	Torque Step 2	Torque Step 3, 4 & 5
SST*, HSE*, CA, MST and MSE with 1/2”-20 brass nuts	15	30	N/A
HP with 1/2”-20 brass nuts	15	35	N/A
HP with 1/2”-20 steel nuts	CALL FACTORY	CALL FACTORY	CALL FACTORY
ELT, TNT, SWT with 1/4”-20 nuts	4	8	N/A
ELT, SWT with 5/16”-18 nuts	7	15	N/A
KHX with 5/16”-24 nuts	7	15	N/A

*HSE units 150 horsepower and larger, SST units 126 horsepower and larger and all AMC use the head bolt torque table.

All torque values are shown in foot-pounds. Always tighten the bolts in a crisscross sequence.



Condenser Head Bolt Torque

Bolt Diameter	Wrench Size	Torque Step 1	Torque Step 2	Torque Step 3, 4 & 5
3/8”	9/16” HEX	15	30	N/A
1/2”	3/4” HEX	30	50	70
5/8”	15/16” HEX	35	70	120
3/4”	1-1/8” HEX	40	90	140
7/8"	2-3/8"	50	100	160

All torque values are shown in foot-pounds. Always tighten the bolts in a crisscross sequence.

Sample torque sequence for SST, HSE, CA and MSE units. Use crisscross pattern for all bolt configurations. For tube in tube units, see the tube in tube gasket replacement section.

Tube-In-Tube Condenser Gasket Replacement Procedure

1. Before starting work ensure that you have the correct gaskets. This can be done by comparing the current gasket with the new gasket to ensure the correct number of bolt holes and pass configurations.
2. Make sure that the fluid supply to the condenser is shut off.
3. ELT, SWT and TNT Units: Remove all of the nuts from the U-bolts, remove the cross bars and the endplates. Take note which side gasket came off each side, since they are different. NOTE: Some fluid will drain from the unit after the removal of the endplates.
4. KHX: Disconnect the front head. Removing as much of the piping as possible, as this will make the removal and replacement of head easier. Remove the nuts and bolts, and then remove endplates. Take note of which gasket came off each side since they are different. Peel off old gasket. NOTE: Some fluid will drain from the unit after the removal of the endplates.
5. If the factory applied epoxy shows any signs of damage, corrosion or pitting on either the tubesheet or inside of the head, it should be touched up or recoated. Follow the epoxy application instructions for more details.
6. ELT, SWT and TNT: Place gaskets into end plates, ensure that the gaskets are installed on the correct side, put end plate against tubesheet and slide cross bars over U-bolts and hand tighten nuts.
7. KHX: Pass bolts through end plates and gaskets and guide endplate into place. Ensure that gaskets are installed on the correct side. Only hand-tighten the nuts.
8. ELT, SWT and TNT: Run down all nuts by hand and torque to step 1, and then step 2. Move from the center bolts to the outer ones.
9. KHX: Run down all bolts by hand tightening one bolt at top, one bolt at bottom, one bolt on right side, one bolt on left side. Follow same sequence and torque bolts to step 1 and then step 2. A wrench must be used on the nut to ensure accurate torque readings.
10. KHX: Re-pipe front head.
11. Turn fluid back on and check for leaks after fluid pressure has been on for at least 10 minutes. If a leak is found re-torque in the same torque sequence 5 ft/lbs. higher.

CAUTION: THE FLUID REGULATING VALVE SHOULD ALWAYS BE INSTALLED ON THE INLET SIDE OF A CONDENSER. THIS WILL PREVENT VIOLENT WATER HAMMER THAT CAN OCCUR WHEN FLUID VALVES SLAM SHUT UNDER CERTAIN CONDITIONS.

WARNING! Never use air-refrigerant mixtures for leak testing. Under certain conditions some refrigerant-air mixtures become flammable.

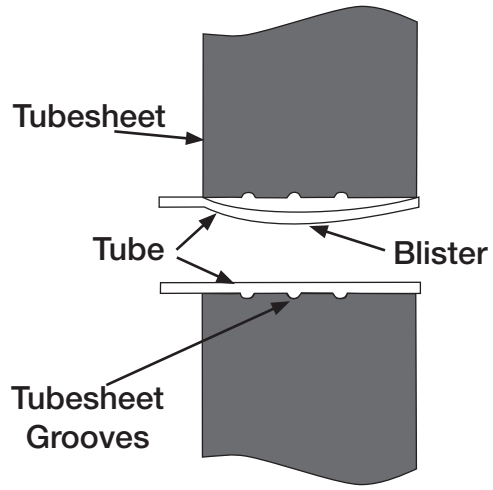
CAUTION: During any pressure testing do not exceed the MAWP (maximum allowable working pressure) displayed on the nameplate.

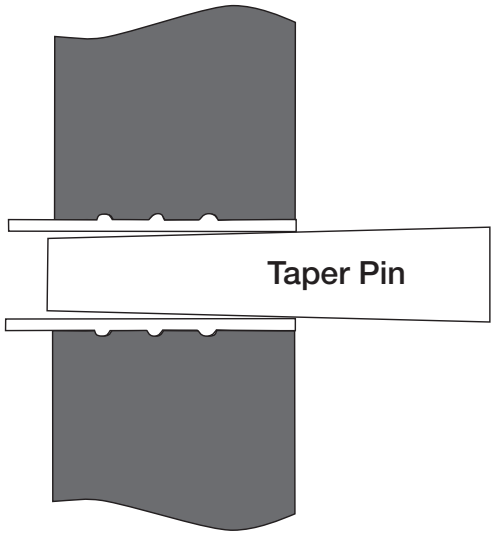
Tube Plugging Procedure

If the unit is still under warranty, please contact Alfa Laval before performing any repairs. Unauthorized repairs will void any remaining warranty.

If you must plug a tube in a heat exchanger, follow the steps below to ensure the repair is permanent.
NOTE: NEVER PLUG MORE THAN 10% OF THE TUBES IN ANY ONE REFRIGERANT PASS.

1. Remove all scale, and excess epoxy. A tube cleaning brush on a drill works well for this
2. If the tube has a blister in it due to a freeze up, you must work it down before installing the plug. This can be done using a large line up punch. Drive the tapered punch into the tube using light hammer taps until the punch bottoms in the hole. Work the punch around the inside of the tube and remove it.
3. Select a plug of the proper size and material. If you are not sure which the correct size is, contact the plug supplier. Plugs can be ordered in one or two pieces, either design will work. To ensure the best fit measure the inside diameter (ID) of the tube after cleaning. If you are making your own plugs measure the ID of the tube to be plugged. The plug should be 3 inches long and taper 0.010" per inch. The ID you measured will be the diameter in the center of the plug, add 0.015", this will be the size of the large end, subtract 0.015" and this will be the size of the small end. In other words if your tube ID is 0.570", the plug will run from 0.555" to 0.585". The material must be compatible with the tube being plugged. Copper and cupronickel tubes should be plugged with brass, carbon steel with carbon steel plugs and stainless steel with stainless steel plugs.
4. When you have the plug ready you must clean the hole. This can be done using Virginia #10e solvent or acetone. Thoroughly clean the inside of the hole and the plug, allow the solvent to evaporate.
5. When installing the plugs, follow the manufacturer's instructions. **CAUTION:** DO NOT DRIVE THE PLUG ANY FURTHER THAN NECESSARY TO SEAL THE PLUG, EXCESSIVE FORCE CAN CAUSE LEAKS IN ADJACENT TUBES.
6. Apply pressure and check for leaks.
7. Cut off the excess plug only if it will interfere with the installation of the head.





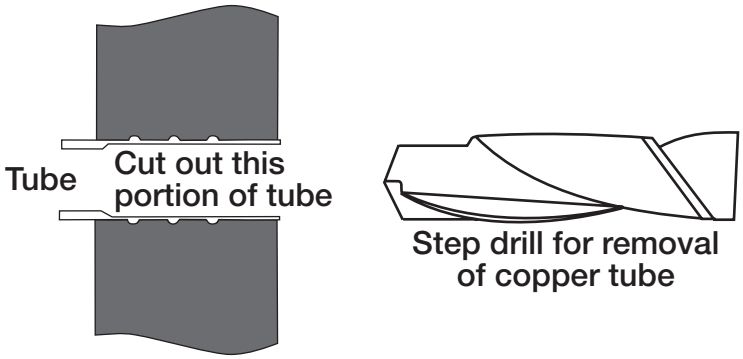
Tube Replacement

If the unit is still under warranty, please contact Alfa Laval Standard before performing any repairs. Unauthorized repairs will void any remaining warranty.

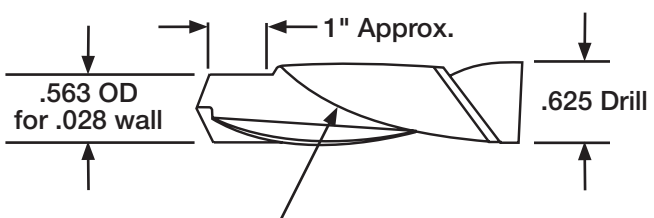
If the number of plugged tubes exceeds 10% of the total tubes in any of the passes, the tubes can be replaced. All tubes must be replaced with the same tube as the originally fitted. Extreme caution should be used so that no damage will occur to the tube sheet holes when drilling out the tube. Damage to the tubesheet holes will result in future leaks.

Tube Removal

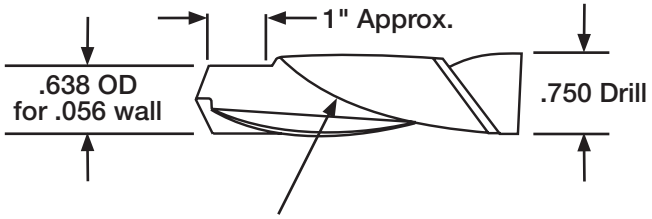
1. To remove any tubes, drill the tube out at both ends until the two grooves in the tube sheet are visible, or within 1/16” of the back face of the tube. CAUTION: Do not drill the tube entirely out of the tube sheet since this will allow the tube to drop out of line with the tube hole.
2. After the tube ends are drilled out, use a step-drive rod to drive the tube. If the tube does not start readily moving from one end, try the opposite end as the tube may be distorted.
3. After starting, the tube should come through the tube sheet easily unless the tube has been expanded or split due to freezing. If this is the case, it will be necessary to flatten a portion of the protruding tube and apply a “C” clamp, with bar plates place on each side of the tube (so additional pressure may be applied).
4. All chips, debris or tube particles must be removed from the tube hole following the removal of the leaking tubes. The grooves in the tube holes must also be carefully cleaned without damaging or scratching the tubesheet hole surfaces.

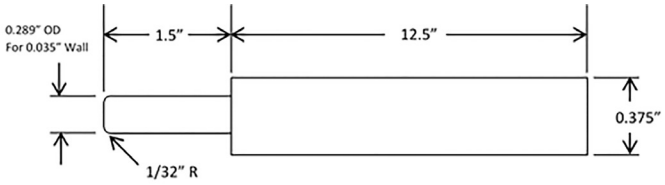


Drill for removing 5/8" OD copper tubing

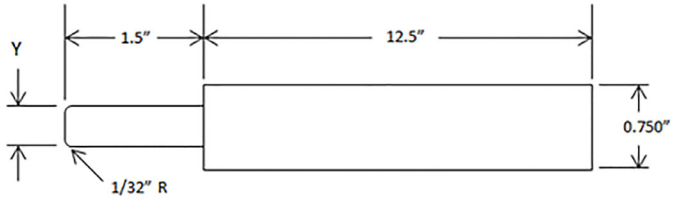


Drill for removing 3/4" OD copper tubing





Drive rod for removing 3/8" OD evaporator copper tubing (not to scale)



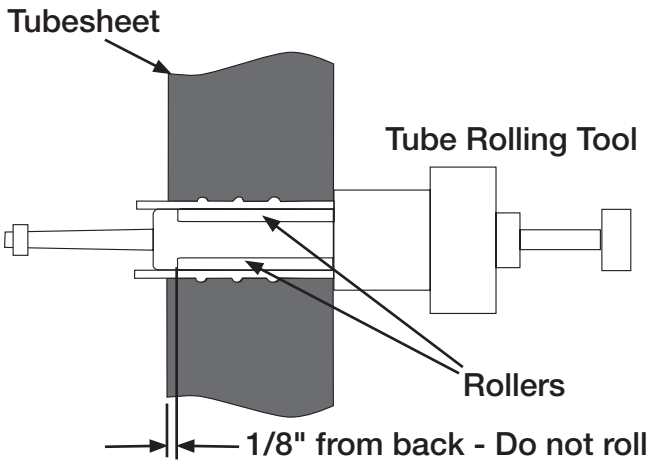
Drive rod for removing 3/4" OD condenser copper tubing (not to scale)

Tube OD	Tube Wall Thickness	Y
0.750"	0.022"	0.575"
0.750"	0.025"	0.570"
0.750"	0.035"	0.606"
0.750"	0.049"	0.656"
0.750"	0.056"	0.650"

For other tube OD and thicknesses please consult the factory.

Tube Installation

1. Inspect groove thoroughly to assure that they are clean and free of foreign material.
2. Insert a new tube until it is flush with both tube sheets. If the tube is slightly longer than the unit, make one end flush with the tube sheet. The other end will have to be cut off after the rolling operation.
3. Insert the tube roller until it reaches the stop. With firm pressure roll expand the tube into the tubesheet. When starting to roll the tube, it is necessary to hold the other end of the tube to keep it from turning. Use extreme caution not to over roll the tube. It is better to under roll and re-roll again after testing than to over roll and have to replace the tube again. Repeat the procedure on the other end. **CAUTION:** Ensure that the rolls and the tube roller are well oiled. **CAUTION:** Rollers must not roll the last 1/8" before the inside surface of the tubesheet.
4. After rolling the tube, carefully grind the tube end flush with the tubesheets using a disc grinder. The tube can also be trimmed flush with an all-cutter.
5. The tube ends should be cleaned to remove any chips or filings that may have collected. Tubes should then be blown out to remove any additional chips or fillings.
6. Check your tube-to-tubesheet joints for leaks by following the Evaporator Tube Leak Test Procedure as shown earlier in this section.
7. Install the gasket and heads following the Evaporator Gasket Replacement Procedure.



Sight Glass Replacement Procedure

If a sight glass is leaking or broken it must be replaced. Use the following instructions below to ensure a permanent repair.

1. Ensure all remaining refrigerant is recovered and the unit is isolated.
2. Unscrew the old sight glass to remove it.
3. It is highly recommended to use new sight glass, however if you are reusing an old sight glass, it must be cleaned. Carefully using a wire brush, dental pick or tap to clean the threads, ensuring to remove all old sealant residues. When using a tap do not cut the threads any deeper, just use it to clean them. Stop any residue from the old sealant reentering the unit, as this can cause contamination and damage the system.
4. Clean the threads on the inside of the coupling and the sight glass with Loctite #7649 primer, Virginia #10e solvent or acetone. Clean as many times as necessary to remove all oil and moisture. Allow all solvent to evaporate fully before proceeding.
5. Apply Loctite #554 thread sealant or equivalent. Put 3-4 drops on the first 2 threads in the coupling and a heavy ring around the sight glass covering the first four threads.
6. Thread the sight glass into the coupling by hand as far as possible and torque to the value specified in the table. Wipe off excess sealant from threads.
7. Allow the sealant to cure at least one full hour before putting the unit back into service, but please be aware the longer it cures the stronger the bond will be.
8. Evacuate properly prior to putting system back into operation.

NPT Size	Part Number	Torque (ft/lbs)
3/8”	N/A	30
1/2”	SG04	40
3/4”	SG06	45
1”	SG08	55
1-1/4”	SG10	65
1-1/2”	SG11	75
2”	GLASS193	100

WARNING! Never use air-refrigerant mixtures for leak testing. Under certain conditions some refrigerant-air mixtures become flammable.

Liquid Level Indicator Maintenance

Location

To enable a liquid level indicator installation, units require a special dedicated factory installed flange. Liquid level indicators are available for 8 5/8” OD and larger horizontal receivers only. Normal location is on the side, centered between the liquid inlet and outlet connections. Other mounting locations can be provided, but this must be specified at time of order. NOTE: At least six inches are required between centers of adjacent units, and also between a unit and the liquid outlet pickup tube. Indicators can be mounted in the center of either end, provided the respective inlet or outlet fitting is moved to at least 1.5 tank diameters from that end.

A sketch must accompany orders indicating the custom location if required.

Description

Liquid Level Indicator model part numbers vary depending on vessel OD and operating pressure. The dial reads the percent of pumpdown capacity of the receiver. When the pointer indicates 100%, the receiver is 80% full of liquid. Pounds of refrigerant can be determined by taking the indicated percentage of the specified pumpdown capacity of the receiver, be aware that some tables show pump down capacity at 90%.

Example

RBV3865 with R-22, dial indicates 75% full and RBV3865 pumpdown capacity 80% full is 39 lbs.

⇨ 39 lbs x 0.75 (indicator full) = 29.25 lbs of R-22

Operation

Movement of the seamless aluminum float rotates a magnet on the inner side of the solid aluminum alloy head. The indicator pointer, or switch contacts, are on the outer side and are operated by a small magnet which follows the position of the inner magnet. There is no connection, except the magnetic field, between the inside and outside. Internal gears and bearings are stainless steel. If any external damage is sustained, the indicators dial or switch cartridge may be replaced from outside so the refrigerant charge is not disturbed.

The seal between the mounting flange and the gauge head is a gasket which is suitable for halocarbon refrigerants. These units should not be used with any other liquids unless the compatibility of the seal and metals has been checked and approved by Alfa Laval Standard.

Installation

Liquid level indicators are an inexpensive, effective means of gauging the refrigerant level in a horizontal receiver. However care must be exercised to properly install the unit to prevent leaks and insure its proper operation. The receiver must be level, especially if the indicator is at one end. Check with a level. The indicator flange face should be vertical. Any projections on the face of the flange caused by shipping or handling must be removed to ensure the gasket seats properly. A very light film of refrigerant oil, or light grease may be used if desired.

CAUTION: Do not use a heavy sealing compound, or anything that sets hard.

Install as follows (see Note for 8 5/8” and 9 3/4”OD units).

1. Make sure the gasket is mounted correctly on the level indicator.
2. Hold head up and float end, then point towards the flange.
3. Start inserting the float into the flange.
4. Swing head down and in at same time (wiggle slightly to check against binding).
5. When all the way in, check to be sure float is free by rotating head slightly each way. Indicator pointer swings with float. The alarm makes no sound, but a slight jar can be felt when the float swings to the upper and lower stops.
6. Keep the indicator head snug against the gasket and rotate it to right side up. NOTE: The upper lug holding the dial, or switch, is rounded, the bottom one is square.
7. Install screws finger tight; then, tighten screws in a crisscross pattern to a final torque of 10-12 ft-lbs. There should be an equal clearance space between the indicator body and the flange face when the required torque is reached.

NOTE: The 8 5/8” and 9 3/4” OD indicators should be started differently, or the float rod may be bent. Hold the unit with the stem horizontal and parallel to the tank; with the head to the right of the flange (upper stop will keep the float from dropping). Swing the head from right to left and in. Check float travel with head about two inches out from the flange, then rotate to right side up and insert the rest of the way.

General Specifications

Gasket: Neoprene flat gasket fits current indicator and alarm adapter on units manufactured after 1972 (Part Number: GASKE995). See Liquid Level Gasket replacement Procedure for more information.

Temperature
Operating temperature range: -30°F to + 150°F.

Humidity
Exposed portion should be painted for marine applications.

Tank pressure
28” vacuum 0 to 500 psi.

Burst pressure
Gasket will unseat at approximately 2,500 psi.

External pressure
Normal atmosphere to 30,000 feet.

Liquid Level Indicator Alarm Maintenance

Model part number: INDIC210A

Application

This indicator-alarm with selectable low-level point is designed for use in applications where low liquid level protection is desirable. It provides a relay circuit that closes at one of five user selectable levels from 10% to 50%. This relay circuit can be used to drive a variety of applications from alarms to pumps. The indicator-alarm also provides a direct, visual indication of the liquid level in the tank.

Description

This liquid level indicator-alarm features a four bolt brass head that accommodates the direct attachment of the 4" steel junction box. Other indicator-alarm components are of either stainless steel or aluminum. All of these metals are fully compatible with common refrigerants and lubricants.

The indicator-alarm float is magnetically coupled to the indicator-alarm sender. This provides a static seal for no-leak reliability and allows the sender to be replaced if necessary without evacuating the tank.

Each indicator-alarm uses highly reliable and accurate three wire voltage divider technology to send the level signal to the level alarm and relay circuitry. The voltage divider uses a thick film element in conjunction with a multi-fingered contact to ensure accuracy and reliability. The connector built into the indicator-alarm mates with a standard Packard automotive type rubber-sealed connector for easy installation and reliable connections.

The case and integral crystal of the indicator-alarm are made of polycarbonate.

The case halves are ultrasonically welded together to obtain a hermetic seal.

General Specifications

Temperature
Operating temperature range: -4°F to +158°F

Working pressure
450 psi

Power Rating
5 amps, 240 volts AC maximum

Voltage Input
110 or 220 volts AC

Liquid Level Indicator Gasket Replacement Procedure

If you need to replace the liquid level indicator (LLI) or LLI block off plate gasket, follow the procedure outlined below:

1. Recover all refrigerant. You must ensure that all pressure is removed prior to the removal of the indicator plate.
2. Remove the 4 bolts and remove the indicator. You will have to work the head around to get the float out. It is okay to deflect the rod slightly, but do not bend it.
3. Clean the flange and indicator gasket surfaces with a solvent such as Virginia # 10e. Also clean the gasket until it has a shiny black appearance. Allow all surfaces to dry.
4. Place the gasket on the indicator and work it back into place. Seat the indicator gasket in the groove machined into the flange.
5. Torque the bolts to 30 inch/lbs in a crisscross pattern and then tighten the bolts to 60 inch/lbs.
6. Pressurize the receiver with nitrogen and test with a leak reactant. If you see a leak identify if it is coming through a scratch in the casting or the gasket. If the leak is caused by damage to the indicator, replace the indicator. If the gasket is the source of the leak, ensure all of the bolts are tight and if necessary tighten to 65 inch/lbs, and retest.

CAUTION: During any pressure testing do not exceed the MAWP (maximum allowable working pressure) displayed on the nameplate.

Evacuation Procedure

Any time you install a new refrigeration component or open a system, you must properly evacuate it. The following steps will help to insure that the system is dry and free from non-condensable fluids. If the system has been flooded due to a freeze-up of a evaporator or condenser follow the dehydration instructions.

Evacuation

1. Pressure test all connections by pressurizing with nitrogen to 150 PSIG and using leak reactant. NOTE: Remember when testing with nitrogen, that it is a non-condensable and will accumulate in the condenser and raise head pressure if it leaks past valves.
2. After you have verified there are no leaks, vent the nitrogen and evacuate to 5000 microns. Use a micron gauge, a gauge manifold is not accurate enough.
3. If using an older single-stage vacuum pump that can only achieve 10,000 microns, break the vacuum with nitrogen, pressurize to 50 PSIG and vent. NOTE: This step is not required with modern vacuum pumps that can achieve better than 500 microns.
4. Evacuate to the level specified by the system manufacturer. If this information is not available, evacuate to 500 microns. Isolate the unit and micron gauge. Note the initial reading and observe the gauge for 20 minutes. The reading should not rise more than 50 microns on a new system and 100 microns on a used system in that time. Any decay above that level is an indication of non-condensable fluids still in the system or a leak. Once the system holds to no more than 600 microns for 20 minutes break the vacuum with refrigerant. Remove the vacuum pump. The system is now ready for charging.

Evacuation Tips

1. Use a large enough vacuum pump, 1 CFM per 7 tons is a rule of thumb. Always start with fresh oil in the vacuum pump. Keep open containers of oil tightly capped since it is very hygroscopic. Change the oil as soon as it shows signs of moisture in it. Keep the gas ballast valve open until the vacuum is down to 29" of vacuum or 25,000 microns, and then close.
2. Use a gauge manifold with a 3/8" vacuum line. Connect the 3/8" hose to the vacuum pump and the two 1/4" lines to the system.
3. Whenever possible remove the cores from the 1/4" SAE fittings that you are connecting your hoses to. If you have done this you should also remove the core depressors from your hoses. The fewer restrictions there are in the path that the vacuum will be pulled through the faster the vacuum will come down. If the ¼” fitting is not installed on an isolation valve, temporary access fittings are available that allow the cores to be removed and reinstalled after evacuation is complete.
4. Low temperatures make it harder to pull a vacuum. Water boils at 101°F at 27.95" of vacuum, but at 53°F you must pull the vacuum down to 29.53" or 10,000 microns, and at 1°F water boils at 29.88" or 1,000 microns. Isolating an evaporator and raising the temperature will make the evacuation go much faster. This can be done by draining the unit and letting it warm up or by running warm fluid through it.
5. If you are evacuating the compressor crankcase make sure that the crankcase heater is on. Change compressor oil as needed.
6. Replace dryer or cores anytime you open a system
7. You can expect to pull 1" less of a vacuum per 1000’ of elevation above sea level.

Dehydration

1. If the failure was in a evaporator, blow the tubes out with nitrogen or compressed air when the repair is done, the tubes are internally enhanced or "rifled" and will hold large amounts of fluid and oil. Anytime spent removing fluids from the tubes before replacing the heads will result in a significant reduction in evacuation time. The condenser is more difficult to dehydrate if it has been flooded. It is usually worth the time and effort cut the copper tubing coming from the refrigerant outlet to drain the unit. To speed this up you can blow nitrogen or compressed air through the safety fitting on the top. Repair the liquid line later with a coupling.
2. Once you have removed the bulk of fluid from the system and you have it all sealed up you can start pulling vacuum. It is strongly recommend using a cold trap. A cold trap is a vessel that goes between the vessel or system being evacuated and the vacuum pump. It holds dry ice and has a chamber which the air being removed passes through. This causes the moisture to condense inside it, thus preventing the moisture from reaching the vacuum pump and contaminating the oil. This speeds the process by eliminating oil changes and allowing the pump to run overnight unattended.
3. Although, you may have reached a good vacuum, you may still have moisture trapped in parts of the system such as suction oil traps. You will have to use dryers to remove the last traces of moisture. It is a good idea to install an oversized liquid line dryer and a suction line drier with replaceable cores to speed up the dehydration process. Use cores with a high fluid capacity. Remember to remove the cores from the suction line dryer once the clean-up is complete or you may have performance problems due to high pressure drop across the drier later. Also replace the liquid line dryer.
4. Change compressor oil prior to starting the system back up. The system should be run for 24 hours and then checked with an acid test kit. Change oil and cores until oil shows no residual acid.
5. Replace the sight glass if the moisture indicating element has been saturated with fluid.

CAUTION: During any pressure testing do not exceed the MAWP (maximum allowable working pressure) displayed on the nameplate.

Decommissioning and Disposal

At the end of any vessel's service life it must be decommissioned and disposed in accordance to local laws and legislations. The decommissioning of any heat exchanger, pressure vessel or other equipment must be performed only by qualified personnel who will operate in accordance with local environment legislation laws.

All fluid must be drained from the equipment before disconnecting any of the pipes. Use the "Evacuation Procedure" and "Dehydration" sections shown in this service manual for more information.

WARNING! Ensure that the vessel and system show zero gauge pressure before disconnecting any bolts or fittings

After draining all of the fluids, some residual parts could remain inside the vessel or equipment, depending on the type of fluids utilized over the lifespan of the equipment. CAUTION: The residual chemicals could potentially be corrosive. If any chemicals remain, the equipment must be rinsed before disposal.

The disposal of any heat exchanger, pressure vessel or associated equipment must be performed by a specialist company who operates in accordance to all local environmental legislation laws.

Heat exchangers and receivers are ≥98% metal. After full decommissioning of the equipment the metal can be recycled. The remaining material is polymeric based (gaskets and plastic baffles). Units which have an external insulation layer (if provided by Alfa Laval Standard), is elastomeric polyurethane. Original packaging material consists of wood and/or cardboard boxes.

All Alfa Laval materials are compliant with the Reach and Rohs regulations. Please contact Alfa Laval Standard if further details are required.

Frequently Asked Questions

Below are some frequently asked questions. If the content doesn't answer the questions that you have, please contact Alfa Laval Standard for assistance.

Can shell and tube heat exchangers be installed in a vertical orientation?

No, units will not work in a vertical orientation. If floor space is a limitation we recommend using a shell and coil, tube in tube or brazed plate heat exchanger, contact Alfa Laval Standard for selection assistance or refer to our product catalog/website.

Can I connect to the threaded IDS connections?

No, the thread on the IDS connections is for testing purposes only, piping must only be brazed to these connections.

Why does the tube side head leak?

First check the bolt torque on each bolt (see the relevant torque charts in the condenser and evaporators sections), if the bolts are loose follow the torque pattern and tighten all of the bolts to the recommended specification

If the bolts are torqued to the correct specification, visually check the condition of the gasket. If the unit has not been serviced recently remove head and replace the gasket (refer to the gasket replacement sections for more details).

For marine units that include a zinc plate anode, these will erode over time and will require the removal of the head and the replacement of both the zinc anode and gasket (refer to the gasket replacement sections for more details).

For marine units with zinc anode plugs, these plugs have weep holes, so when enough of the zinc has eroded the seawater will drip through the hole. Simply replace the zinc plug anode with a new anode. Call Alfa Laval Standard for a genuine replacement part number or refer to the catalog.

What is the recommended braze material for connecting pipes?

Use 45% or higher silver content solder and the proper flux for steel to copper joints and 15% for copper to copper

Can I weld to the shell of the heat exchanger?

We do not recommend welding to the shell of the heat exchanger as this can damage the internal structure

Welding to any pressure retaining surface will invalidate the ASME rating, any weld repair will require retesting and recertification of the vessel by a qualified welder

If the unit has weld pads mounted on the shell surface, it is possible to weld to these surfaces without needing to retest the vessel, if weld pads are required please contact the Alfa Laval Standard before placing any orders

Do the units require filtration systems?

Shell and tube heat exchangers are less susceptible to plugging, but it is still required to have a filter installed upstream on both the refrigerant and fluid side

Regular inspection and replacement of the filters is highly recommended as part of the regular service program

Can I swap the front and rear heads?

Evaporators can be swapped, provided the water inlet is close to the refrigerant connections head. Condensers please consult the factory

How to contact Alfa Laval
Contact details for all countries are
continually updated on our website.
Please visit www.alfalaval.us to access the information directly.

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